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Northeast Ohio Front Runners: Groups of Regional Industry Drivers (GRIDs)

Iryna Lendel
Cleveland State University, i.lendel@csuohio.edu

Merissa Piazza
Cleveland State University, m.c.piazza83@csuohio.edu

Iryna Demko
Cleveland State University, i.demko@csuohio.edu

Jinhee Yun

Samuel Owusu-Agyemang

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NORTHEAST OHIO FRONT RUNNERS: GROUPS OF REGIONAL INDUSTRY DRIVERS (GRIDS)

Prepared for:

THE GEORGE GUND FOUNDATION

Prepared by:

Research Team Led by

Iryna V. Lendel, Ph.D.

November 2018

CENTER FOR ECONOMIC DEVELOPMENT

1717 Euclid Avenue Cleveland, Ohio 44115
levin.urban.csuohio.edu/ced

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About the Study Team

Iryna V. Lendel, Ph.D. is the Director of the Center for Economic Development and a Research Associate Professor at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. Dr. Lendel was the principal investigator for this project. She is an economist with vast experience conducting academic and applied economic research analyzing regional and urban economic development. Her research portfolio includes projects on industry analyses, state and regional science and innovation policies, and multiple economic impact studies. She serves in an advisory capacity in national and state economic development organizations and is an assistant editor of Economic Development Quarterly.

Merissa C. Piazza, Ph.D. is a Program Manager at the Center for Economic Development and specializes in economic development, metrics and indicators, and survey research. Dr. Piazza is an economist with extensive experience conducting applied research and academic studies. Her research portfolio includes projects on entrepreneurship, investigating high-growth firms, analysis of the adoption of technologies in industries, navigating industry workforce development issues, and overall industry analysis.

Iryna Demko, Ph.D. is a Research Associate at the Center for Economic Development. Dr. Demko holds her Ph.D. degree in Agricultural, Environmental, and Resource Economics from Penn State University. She has co-authored several reports at the Center on economic impact, workforce development, economic development, industry analysis, and agriculture. She is an expert on food systems, organic agriculture, and economic impact analysis.

Jinhee Yun is a graduate research assistant with the Center for Economic Development and is a Ph.D. candidate in Urban Studies and Public Affairs at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. Ms. Yun performed statistical data analysis for this study.

Samuel Owusu-Agyemang is a graduate research assistant at the Center for Economic Development and a Ph.D. student in Urban Studies at the Levin College of Urban Affairs at Cleveland State University. Mr. Owusu-Agyemang assisted in data analysis at various stages of this study, especially in examining GRID supply chains. He also conducted literature review of cluster analysis and assisted in data visualization.

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EXECUTIVE SUMMARY

This research provides relevant, data-driven insights on competitive industries in the Northeast Ohio (NEO)[1] economy over the 2013-2017 period. This report informs the reader on industries that over the last five years outperformed their national counterparts in wealth creation. These industries employ a significant amount of regional workforce, create sizable output, and have a regional competitive advantage. This research updates previous research conducted by the Regional Economic Competitiveness Strategy in 2011 and provides up-to-date insights into the future growth areas of NEO's regional economy.

NEO economic trends over the last twenty years are typical of the Midwest region, with a positive increase in output outpaced by the state of Ohio, and the United States. The double recessions of the early 2000s and 2008 show a deeper output decline in NEO than in comparable Midwest regions and the United States. Regions, now more than ever, are competing with national and international markets and seeking to regain traction against other areas. Several initiatives have been developed in NEO to reduce this persistent lag with peer regions. NEO executed a regional strategy focused on targeting and increasing innovation—initiatives sought to fund research and development, focus on advanced manufacturing, recruit innovative companies, and support entrepreneurship.

Using statistical analyses, we identified groups of industries with strong regional specialization, competitive advantage, growing output, and growing productivity. We call these groupings GRIDs - Groups of Regional Industry Drivers. Three groups of industries met the criteria: *Professional Services*, *Growing Legacy Manufacturing*, and *Oil and Gas*. These three industry groups contributed nearly 40% to NEO's total output ($86.5 billion) and employed 20% of NEO workforce (363,660 people).

Groups of Regional Industry Drivers (GRIDs) in NEO

- The Professional Services GRID provided the largest share of output, 71% ($61 billion), among all GRIDs. The core of this group are industries such as finance and insurance, company headquarters, hospitals, and real estate. The growth of these industries is driven by increasing productivity and significant regional specialization.
- The Growing Legacy Manufacturing GRID consisted of 20 industries in steel-making, machine shops, chemical and tools manufacturing with a high concentration in the region compared to the U.S. They were responsible for 22% ($19 billion) of GRIDs output and showed strong growth. These industries emerged from the recession restructured and competitive.
- The Oil and Gas GRID is an emerging industry group for the NEO economy; it is small, but due to its capital intensive nature it contributes sizeably to output. Industries in this group account for 7% of GRIDs output ($6 billion). The Oil and Gas GRID needs to increase in size and economy of scale to significantly impact overall regional performance.

[1] Northeast Ohio includes 18 counties: Ashland, Ashtabula, Columbiana, Cuyahoga, Erie, Geauga, Huron, Lake, Lorain, Mahoning, Medina, Portage, Richland, Stark, Summit, Trumbull, Tuscarawas, and Wayne.

Recent Developments

Summer 2018 saw growing rhetoric from U.S. government officials about increasing tariffs on many foreign-produced products. Based on this threat, retaliatory tariffs from China, the European Union, and Canada were announced which may significantly impact manufacturing industries in NEO. Estimates show that among the four NEO MSAs,[2] between 3,000 and 8,000 jobs could be affected by tariffs on *Aircraft Products and Parts Manufacturing*, *Basic Chemicals*, *Resins and Synthetic Rubber Manufacturing*, *Nonferrous Metal Products*, *Iron and Steel Product Manufacturing*, and *Miscellaneous Purpose Machinery* – all of which are related to regional GRIDs.[3] While global and national policies are outside of regional control, it is essential for regional economic development strategies to be responsive to global influences and risks.

In March of 2019, General Motors announced plans to discontinue production of the Chevy Cruze, idling the GM Lordstown Plant while cutting 1,600 jobs; this was on top of already deep workforce cuts when the plant eliminated second shift workers in July 2018 (1,500 jobs) and the third shift in February 2017 (1,200 jobs).[4] It is estimated that the total economic impact of these cuts is upwards of $8.2 billion. The *Motor Vehicle Manufacturing* (NAICS 3361) industry in NEO is among the legacy manufacturing industries currently losing their competitive advantage. In 2017, it contributed $747 million to NEO output. Over the 2013-2017 period, its effective output in the region declined 22%, compared to 19% growth national-wide.

Overall, the NEO's regional economy shows signs of growth, but it is lagging in contrast to other comparable Midwest regions and the nation. Manufacturing continues to play an important role in the region, and many of these industries regained their competitive advantage post-recession. Rebalancing NEO economy to become more aligned with overall U.S. structure can help to protect the local economy from economic downturns.

[2] The Akron MSA, the Canton-Massillon MSA, the Cleveland-Elyria MSA, and a part of the Youngstown-Warren-Boardman, OH-PA MSA

[3] Parilla, J. & Bouchet, M. (2018). Which U.S. communities are most affected by Chinese, EU, and NAFTA retaliatory tariffs?. *Brookings*.

[4] Lordstown's WARN Notices provided by ODJFS.

INTRODUCTION

What does it mean to be competitive? Competition lies at the core of business development and operations—from pitching to investors and launching new products to harnessing innovation for long-run profits. For economists, competition is crucial for maintaining efficient wealth creation and distribution of resources. For consumers, the same competition brings lower prices and new products and services—more fuel-efficient cars, thinner and more feature-rich cell phones, and medical devices which enhance and extend our lives. However, in the short-term, competition can also be disruptive for employees—over the last ten years, restructuring and outsourcing of jobs to international markets impacted many Northeast Ohioans.

The goal of this research is to provide up-to-date, data-driven insights for competitive industries in the Northeast Ohio (NEO) economy. This report updates the study conducted to define driver industries for the Regional Economic Competitiveness Strategy (RECS) developed in 2011. NEO civic leaders have had a longstanding interest in learning how to foster stronger regional wealth creation and employment growth. To that end, various efforts have been made over the past few decades to study regional growth dynamics, to benchmark our region's performance against peer regions, and to undertake initiatives designed to close gaps. Simply put, NEO has lagged the performance of the nation and most peer regions, for reasons that are not fully clear. The most recent effort to track progress and gain insight was RECS in 2011. Given the enormous impact of the Global Financial Crisis and Recession, and its devastating aftermath, civic leaders asked for an update based on the most current data.

Dynamics of industries are defined by the businesses that make up industry groups. Businesses and industries must continually develop new products and seek new markets to remain competitive. If a company is to increase revenues, it must either sell more goods, increase productivity, or become more efficient in production. Companies and industries must not only sell to those within their footprints but also export their products to customers in other locations—either domestic or international. Industries also can become more efficient and increase productivity by using unique regional resources – whether through technology adoption, skilled labor, existing infrastructure, or natural resources. Efficiency and productivity increases are both good for regional economies because competitive industries can improve growth in both output and jobs.

Traditionally, industries which export and innovate have a regional specialization which gives them a competitive advantage. Such industries are called *economic base industries*; they drive regional economies by creating wealth, paying competitive wages, and innovating to drive business further. Within this study, we categorize these industries as a part of a growing or declining economic base. A growing economic base industry is one that has a regional competitive advantage compared to the nation and shows signs of growth (primarily in wealth creation or productivity). A declining economic base industry, on the other hand, is one that lost or is losing regional competitive advantage compared to the nation and shows signs of decline; many of these industries did not restructure and recover from the recession. The study

also refers to some "legacy" industries – those that historically belonged to the growing economic base, had a significant presence in our region directly and through their supply chain, and once were driving regional economy.

Objective & Methodology

This research uses the results of economic analyses conducted on current data to identify Groups of Regional Driver Industries (GRIDs) for the 18-County Region of NEO.[5] It also considers historical NEO economic development strategies based on regionally competitive industries.[6] Examining GRIDs can provide decision-makers with a road-map of economic base industries which are growing, declining, or emerging in the regional economy. Regional leadership and governments can craft data-driven public policy informed of GRIDs and their description to support and encourage economic growth and mitigate economic declines. These industries should be further discussed within the region on their inclusiveness, competitive wages, and employment dynamics.

The research is focused on examining industries from a wealth-creation economic development objective. The methodology used in this study closely replicates the methodology deployed in a previous iteration of defining NEO economic driver industries to underline the 2011 NEO RECS.

Using the wealth-creation indicators of industries, we conducted statistical analyses to form, identify, and analyze the characteristics of industry groups to discern GRIDs. Variables used in the model examined the competitiveness of industries (a change in wages, output, and productivity), importance to the regional economy (share and concentration of output, wages, and employment in the regional economy), and comparison to the national economy (a share of national GDP and wages and local competitiveness component of a shift-share analysis using output and employment).

GRIDs constitute the growing economic base of a region; they present regional specialization, produce products that a region trades with other regions and countries, and utilize a workforce with a set of particular skills and occupations. One of the potential advantages of regionally concentrated industries lies in their established supply chains—groups of companies selling products and services to regional driver industries. An increase in sales to the driver industry also generates business and brings jobs and wages to their supply chain companies. It is important to note that supply-chain companies are not necessarily contained within each driver industry group, and therefore, they create opportunities for supply chain companies in other

[5] Northeast Ohio includes 18 counties: Ashland, Ashtabula, Columbiana, Cuyahoga, Erie, Geauga, Huron, Lake, Lorain, Mahoning, Medina, Portage, Richland, Stark, Summit, Trumbull, Tuscarawas, and Wayne.

[6] Starting in 2006, the Fund for Our Economic Future (FFEF)—in collaboration with the Upjohn Institute, the Federal Reserve Bank of Cleveland, and Cleveland State University—began monitoring Northeast Ohio industries by examining factors for regional growth in the economy. The study, known as the "Dashboard", monitored the economy through several iterations including "What Matters to Metros" in 2012. The Dashboard project grew into a regional economic development strategy when, in 2012, the FEFF sought to examine regional driver industry groups. This strategy then formed the Regional Economic Competitiveness Strategy (RECS).

industries. Regions benefit when a robust economic base of driver industries and an extensive supply chain of companies are both present within the region.

Some of the industries within GRIDs are capital-intensive and do not employ many people. However, these industries contribute to the regional economy by typically paying high wages to their employees and creating jobs and wages for companies within their supply chain. By providing increased disposable income, these capital-intensive industries fuel business for population-serving companies due to increased purchasing of consumer goods and services.

STRUCTURE OF NEO REGIONAL ECONOMY

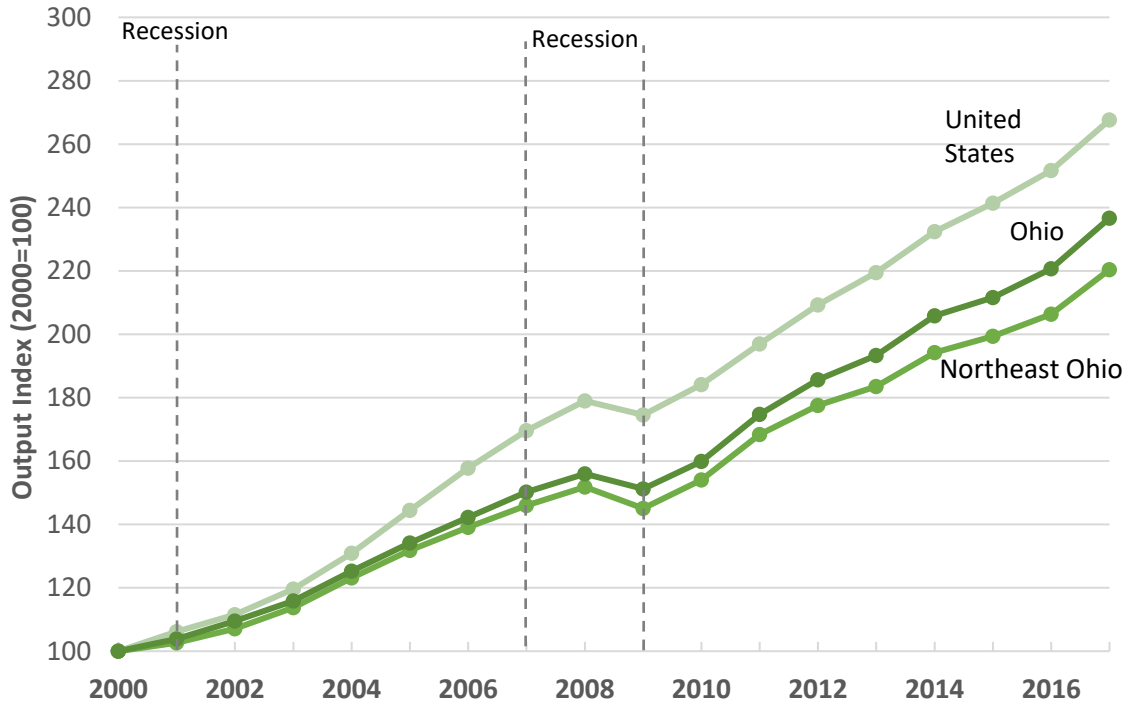
Trends in NEO Region

It is important to acknowledge the region's past to understand its present and future. The regional economic dynamics of NEO were built on manufacturing and immigrant labor, fueling both economic and population growth. The NEO region worked steel, built cars, made tires, and supported a population of over 4.6 million in 1970; this manufacturing legacy comprised 35% of the economy in NEO – equating to 1.7 million jobs. By 2017, several significant recessions in the 1990s and 2000s had restricted domestic consumption, and industry mainstays of steel, cars, and tires saw substantial downturns. Coupled with deregulation in the global economy, which subjected NEO to economic restructuring and offshoring, this brought about a new reality—abandoned factories, lower risk tolerance, and a mindset unproductive for entrepreneurship.

Looking back, we can confirm that the regional economy was over-concentrated in manufacturing compared to the overall U.S., which caused deeper declines and slower recoveries compared to regions with better-diversified industrial portfolios. Economic growth (and decline) can come from short-run changes in consumption or long-run (structural) changes in the overall economy subjected to population change, technological cycles, or the discovery of new natural resources. Examining the production of overall economic values and activity informs where and how wealth is created—which can consequently build an understanding of where workforce resources can be applied.

NEO economic trends over the last twenty years are typical of the Midwest region, with a positive increase in output outpaced by the broader United States (Figure 1). The double recessions of the early 2000s and 2008 show a deeper output decline in NEO and Ohio compared to the U.S. Starting in 2010, NEO economic activity—as expressed through gross regional product (output)— began catching up with national trends, with every metro area in NEO gaining traction (Figure 1).

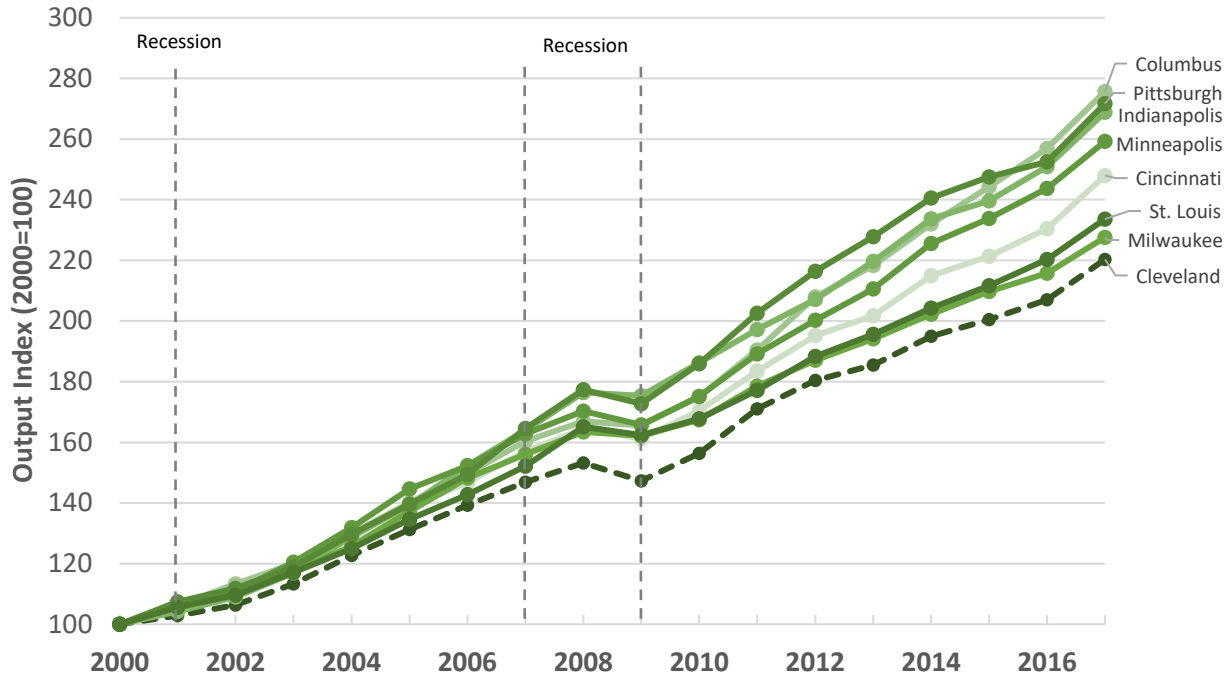
Figure 1. Long-Term Output Trends



Source: Moody's Analytics

The United States has traditionally outperformed Ohio and NEO because of the strong growth in technology industries on both coasts. Viewing that as a foundational argument, we looked at regions comparable to Cleveland—sharing similar population sizes, economic structures, and Midwest locations. Output trends over the last twenty years show a deeper decline in the Cleveland MSA than in all other Midwestern regions (Figure 2). As the economy was hit hard during the 2008 recession, it is consequently lagging in recovery. Additional research would be useful for understanding structural differences between similar regions and how various economies relied on regional drivers to recover from typical Midwestern decline.

Figure 2. Regional Output Trends, 2000-2017



Source: Moody's Analytics

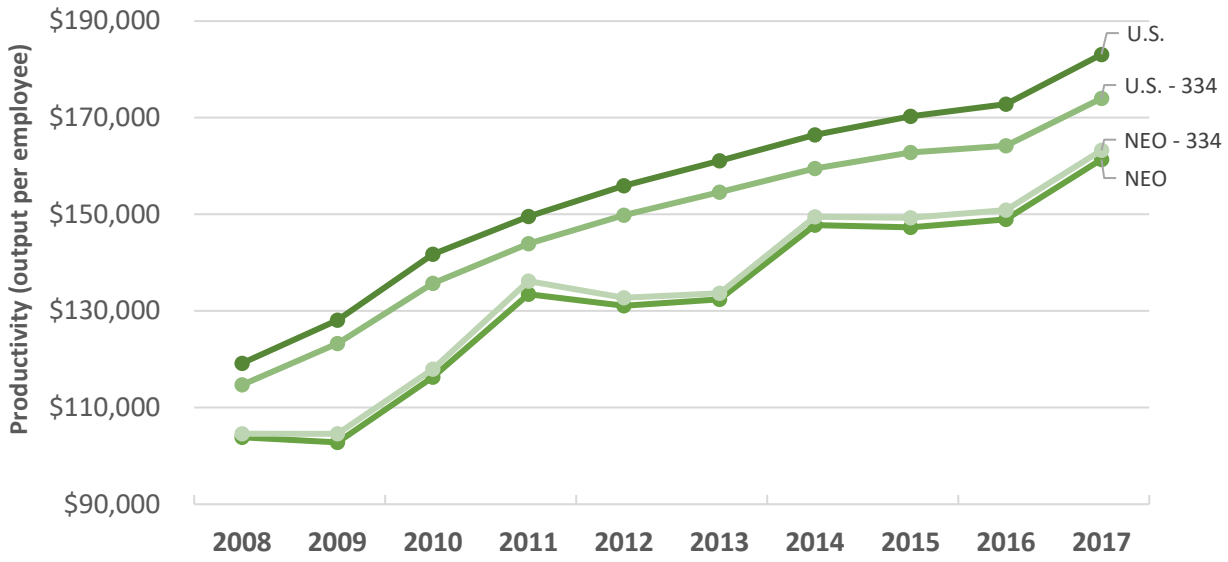
NEO industry performance showed improvements through productivity gains, mitigating the effects of prior manufacturing over-concentration. Even in 2017, when manufacturing was only 13% of the overall economy, the region still had 4% more manufacturing than the U.S. (13% in NEO versus 9% across the US). Considering 2017 productivity levels[7], the U.S. had 12% higher productivity in manufacturing than NEO (Table 1).

Some economists[8] point to problems with output measurements related to inflated values for Computer Manufacturing and Electronic Product Manufacturing.[9] These two sectors cause a disparity between Coastal U.S. regions and the rest of the U.S. due to product improvement and technological progress; these industries also increase the U.S. total output and inflate U.S. average productivity numbers—since not every region can specialize in these industries, it is useful to compare productivity outside of these two sectors.

Notably, the gap in manufacturing productivity between NEO and the U.S. is three times smaller if measured without Computer Manufacturing and the Electronic Product Manufacturing sectors (NAICS 334). So, omitting these two sectors, manufacturing productivity in NEO is more competitive (Figure 3). While the gap between NEO and the U.S. in manufacturing productivity is closing, productivity disparities between NEO and national service industries are still high ($105,947 in NEO versus $121,539 in the U.S.).

[7] For this study, productivity is approximated by an indicator gross regional product (output) per employee.
[8] Economists Susan Houseman and Timothy Bartik wrote extensively on this topic.
[9] These two sectors of manufacturing in popular literature refereed as Computers and Semiconductors.

Figure 3. Manufacturing Productivity in the U.S. and NEO with and without Computer and Electronic Product Manufacturing Sectors (NAICS 334)



Source: Moody's Analytics

NEO is re-balancing its economic structure to be less concentrated in manufacturing; it is becoming more aligned with the overall U.S. structure, which can protect the region from recessionary pressures. At the same time, expanding to the service sector with a significant gap in productivity may introduce a risk of falling behind for different reasons.

Table 1. Contributions of Manufacturing, Services, and Agriculture, 2017

Sector	Employment Share		Share of GDP		Productivity (GDP/Employee)	
	U.S.	NEO	U.S.	NEO	U.S.	NEO
Manufacturing	9%	13%	13%	19%	$183,104	$161,375
Service[10]	89%	86%	87%	81%	$121,539	$105,947
Agriculture	2%	1%	1%	0.3%	$47,746	$25,098

Source: Moody's Analytics

[10] Service includes Utilities; Wholesale Trade; Retail Trade; Transportation and Warehousing; Information; Finance and insurance; Real estate; Professional Services; Management; Administrative Services; Education Services; Health Care; Arts; Accommodation; Other Services; and Public Administration.

New Regional Dynamics

Regions are competing with national and international economies more than ever as traditional restrictive economic boundaries have opened and placed global markets within reach.[11] This shift makes regional public policy interventions critical for policymakers aiming to help companies struggling to gain productivity and enter competitive circles, typically by embracing innovation. Public policy can help overcome market failures such as inadequate industry mix and non-competitive industries by fostering entrepreneurship, innovation, and economic inclusion—ultimately translating into new business growth.[12]

In the 1990s, Northeast Ohio formed a regional economic development strategy which sought to remedy market failures in industry sectors through the efforts of various economic development intermediaries. The inception of the Greater Cleveland Partnership, Team NEO, JumpStart Inc., NorTech, BioEnterprise, and MAGNET focused energies on targeting innovation— whether through funding research and development, focusing on advanced manufacturing, recruiting innovative companies, or supporting entrepreneurship with an emphasis on technology high-growth firms.

Since the early 2000s, NEO and Ohio joined other Midwestern states that persistently invested in innovation and talent assets aiming to translate it into new businesses and jobs. A recent Brookings article on Midwest talent provides statistics on innovation assets for 12 Midwest states which are home to "more than 200 of the nation's Fortune 500 companies and 20 of the world's top 200 research universities," noting that "the upper Midwest generates 26 percent of the nation's corporate and university patents and 31 percent of its university-based research and development… [including] one-third of the nation's highly competitive National Institute of Health research funding." [13] NEO is home to Case Western Reserve University (CWRU), ranked 126 in the top 200 research universities worldwide. It is also home to further higher education assets, and professional education institutions focused on developing innovation and preparing talent entering the economy. The strength of NEO's historical corporate presence, along with universities' resources for innovation and workforce, multiplied by generations of skilled labor which has spawned a maker-culture can create a starting point for economic recovery. The next 20 years of investment in regional restructuring and innovation, as a long-term process, is a journey worth embarking upon for NEO.

After decades of struggling to recover, the region is starting to show signs of growth founded upon economic restructuring efforts. The following section identifies groups of industries with strong regional specialization, competitive advantage, growing output, and growing productivity. We call these groupings GRIDs - Groups of Regional Industry Drivers. We further discuss a group of industries currently lagging in economic performance.

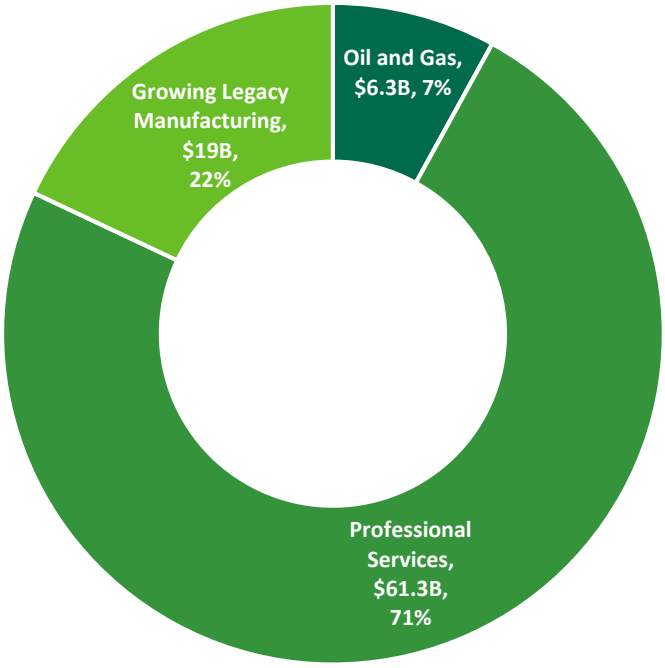
[11] The recently started tariff war undermines this statement, see the final chapter for a longer discussion.
[12] Bartik, T. J. (1990). The market failure approach to regional economic development policy. *Economic Development Quarterly*, 4 (4), 361-370.
[13] Austin, J.C. (2018, August 14). The Rust Belt needs capital to turn talent and innovation into jobs. *Brookings*.

GRIDS: GROUPS OF REGIONAL INDUSTRY DRIVERS

This section of the report examines Groups of Regional Industry Drivers, or GRIDs, which had a strong regional specialization (indicating that they export their goods or services), grew output, increased productivity, and illustrated positive components of local competitiveness[14] over the last five years. In all, we identified three groups of industries that met these criteria: *Oil & Gas* (3 industries), *Professional Services* (10 industries), and *Growing Legacy Manufacturing* (20 industries). These industries are at the core of what drives wealth creation and output in the NEO economy. We discuss their characteristics, including contribution to regional output and supply chains.

Figure 4 displays the 33 industries that comprise all GRIDs; they contribute to about one-third of regional output in NEO ($86.5 billion of $233.7 billion). Of this, the Professional Services GRID accounted for the largest portion of all three GRIDs ($61.3 billion). The Growing Legacy Manufacturing GRID contributed $19 billion, and the Oil and Gas GRID consisted of $6.3 billion (7%).

Figure 4. Share of GRIDs Contribution to Output, 2017



Source: Moody's Analytics

[14] Based on employment and output regional and national analysis.

Oil & Gas GRID

Oil and Gas is not an industry typically associated with Northeast Ohio. However, new technologies have made extracting oil from shale rock deep in the earth more viable, and Northeast Ohio is fortunate to have these deposits. The Oil and Gas GRID (Table 2) is made up exclusively of industries comprising oil and gas drilling and production. The six-years growth of the Utica shale development is strongly reflected in regional imprint with the *Oil and Gas Extraction* (2111), *Pipeline Transportation* (4860), and *Petroleum and Coal Products Manufacturing* (3241) industries reflecting upstream, midstream, and part of the downstream product value chain of the NEO shale development.[15]

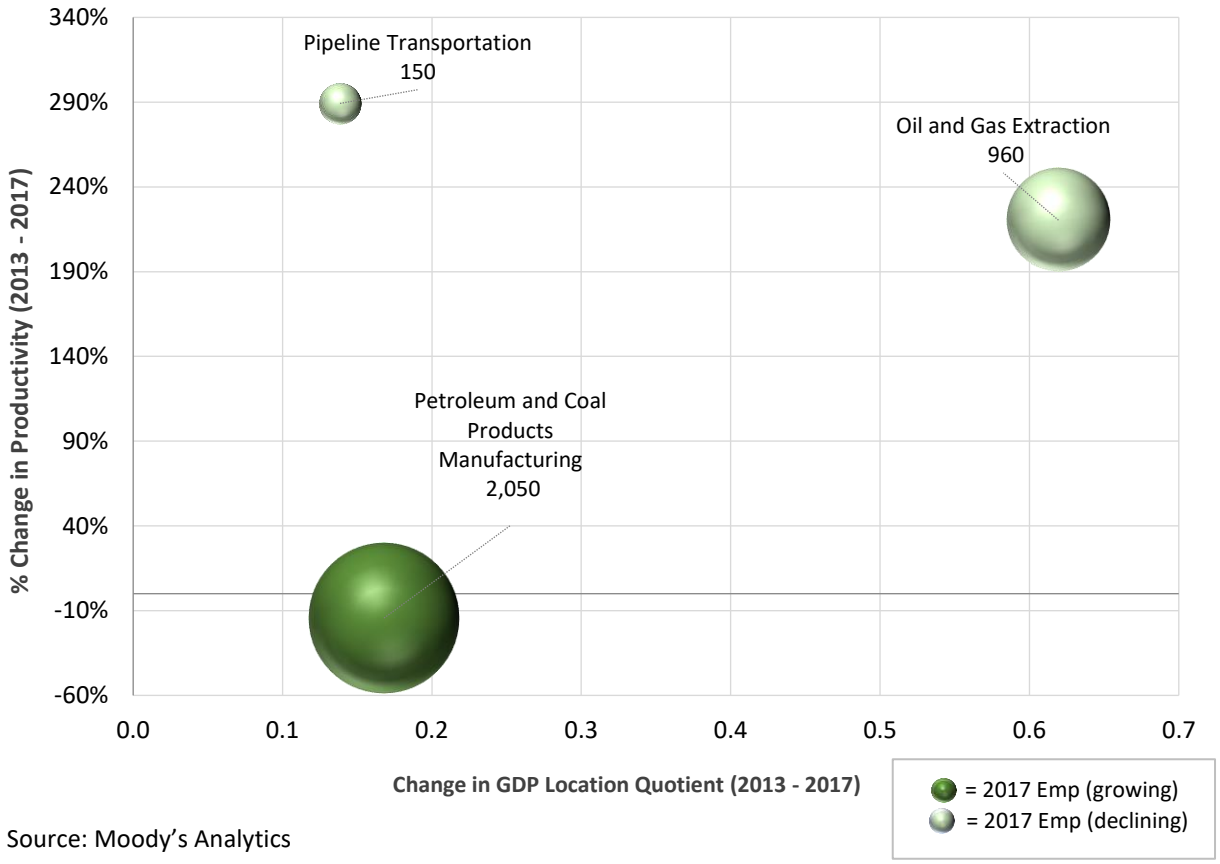
Table 2. Industries in NEO Oil and Gas GRID

NAICS code	Industry Name
2111	Oil and Gas Extraction
3241	Petroleum and Coal Products Manufacturing
4860	Pipeline Transportation

The *Pipeline Transportation* (4860) industry grew in kind due to an increase in the production of pipelines carrying natural gas and other products. As shown in Figure 5, the industry has increased its productivity by almost 300% over the last five years. The *Oil and Gas Extraction* (2111) industry has also seen massive growth in productivity and is gaining a strong regional presence. Furthermore, the industry has seen double-digit growth in output since the recession and exhibits rapidly growing specialization – making it a fast-growing, emerging economic base for NEO. The *Petroleum and Coal Product Manufacturing* (3241) industry is not new to the region, due to the historical presence of Marathon Refineries and Dominion Energy Ohio. This industry is the largest employer in the Oil and Gas GRID, and its productivity has declined over the last five years due to growing employment.

[15] Lendel, I., A. R. Thomas, B. Townley, J. C. Dick. (2015). *Urban Publications*. Mapping the opportunities for shale development in Ohio." 2015. Retrieved from https://engagedscholarship.csuohio.edu/urban_facpub/1328/

Figure 5. Oil & Gas GRID - Industry Dynamics, Productivity, and Specialization



Source: Moody's Analytics

Professional Services GRID

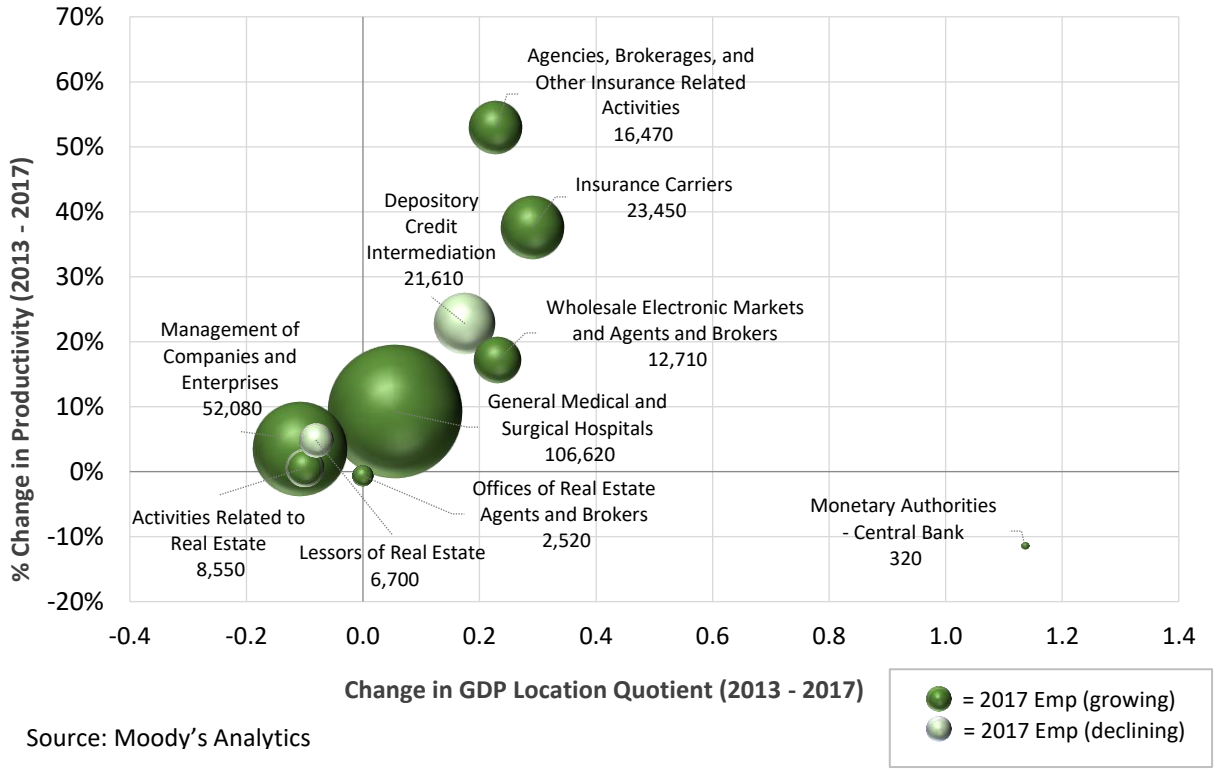
The bulk of the Professional Services GRID consists of ten industries which provide services to businesses and individuals (Table 3). This GRID contains a subset of service industries with significant regional specialization that export their services and expertise to other regions. The best example is the banking industry, encompassing the Federal Reserve Bank of Cleveland (*Monetary Authority – Central Bank*) and the general banking industry in NEO (*Depository Credit Intermediation*). The Federal Reserve is a major magnet institution, providing services to not only the remainder of Ohio outside of NEO but also western Pennsylvania, eastern Kentucky, and the northern panhandle of West Virginia. It also supports the banking industry, which is a substantial employer in NEO. These two industries employ highly skilled, high-wage workers and serve as a draw for other highly-educated workers seeking internships, collaborative research, and employment or those visiting for organized events.

Table 3. Industries in NEO Professional Services GRID

NAICS	Industry Name
4251	Wholesale Electronic Markets and Agents and Brokers
5211	Monetary Authority – Central Bank
5221	Depository Credit Intermediation
5241	Insurance Carries
5242	Agencies, Brokerages, and Other Insurance Related Activities
5311	Lessors of Real Estate
5312	Offices of Real Estate Agents and Brokers
5313	Activities Related to Real Estate
5511	Management of Companies and Enterprises
6221	General Medical and Surgical Hospitals

All industries in the Professional Services GRID have a high concentration in the region, and their growth is driven by high productivity and a high share of regional output, which are both indicative of strong economic activity (Figure 6). Insurance carriers, agencies, brokerages, and other insurance-related activities increased their productivity by nearly 50% and gained regional specialization as well as employment over the last five years.

Figure 6. Professional Services GRID - Industry Dynamics, Productivity, and Specialization



Source: Moody's Analytics

Four features set this group apart from the other professional services in the region. First: all but the real estate industries in this GRID export services outside the area or have higher than average concentration of this industry regionally. This higher concentration is a product of providing services not only outside the region but also within NEO to other export industries selling products outside the region. In other words, the growth of the financial and insurance industries in this GRID can be attributed to fast-growing industries and exports.

Second, most of these industries are high-performing. The *General Medical and Surgical Hospitals* (6221) industry in NEO not only serves the local population—as most hospitals do—but is also becoming a national and international destination for healthcare and research. These hospitals serve as innovation hubs for biomedical research—delivering services to patients traveling to the area from across the globe—and comprised of anchoring institutions for economic and community development, contracting large regional supply chains. Moreover, this industry employs a large share of the local population in low- and medium-skilled jobs that provide living wages and stable employment. Furthermore, these hospitals are magnets for high-wage, high-skilled workers who provide services and research to the overall industry.

Third: Northeast Ohio accounts for about one-third of the state's population, output, and employment. Cleveland historically housed—and remains home to—many headquarters anchoring companies in NEO but servicing much larger regions. These industries support the region's historical designation as a nationally-ranked metropolitan area for a high concentration of corporate headquarters; in this category, NEO surpasses San Francisco, Boston, and New York.[16] Large national and international players in insurance, banking, and manufacturing keep headquarters in NEO. Headquarter functions require high-skilled, high-wage employment such as executive positions, financial professionals, and lawyers; furthermore, these functions traditionally co-locate with corporate R&D service establishments.

Finally, industries in the real estate and wholesale sector export services because they are in the supply chain of other leading GRIDs. The Oil and Gas industry accounts for significant real estate services (5311, 5312, 5313), both used locally and producing export services.[17] Real estate services are needed for leasing land for drilling, pipeline construction, and selection and leasing of sites for operators and their supply chain companies. Also, *Wholesale Electronic Markets and Agents and Brokers* (4251) is a B2B industry serving many other export businesses.

[16] Grzelewski, J. (2018, August 13). Team NEO report finds Northeast Ohio is hub for corporate headquarters. *The Vindicator*. Retrieved from http://www.vindy.com/news/2018/aug/13/northeast-ohio-called-hub-for-corporate-/

[17] In the case of real estate, their services will be "exported" outside of Northeast Ohio to other Ohio counties leasing land for oil and gas development and providing sites to companies servicing this development.

Growing Legacy Manufacturing GRID

Manufacturing has been a fundamental and distinctive feature of the regional economy and has historically imposed both its strengths (high-paying jobs, large supply-chain) and its weaknesses (it is strongly influenced by global markets) on Northeast Ohio. Economic restructuring in this industry over the last ten years has left many people with a cautious view of manufacturing but did not change the fact that the sector remains an essential component of a vital and growing NEO.

Growing legacy manufacturing industries include steel and aluminum making, machine shops, and paint & coating industries which are again driving wealth creation in NEO (Table 4). Examining the Growing Legacy Manufacturing GRID reinforces manufacturing's status as an essential contributor to our economy; since the substantial decline of manufacturing in the 2000s, these legacy industries have restructured their business models to be competitive in the global manufacturing environment.

Table 4. Industries in NEO Growing Legacy Manufacturing GRID

NAICS	Industry Name
3251	Basic Chemic Manufacturing
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg
3255	Paint, Coating, and Adhesive Manufacturing*
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3271	Clay Product and Refractory Manufacturing
3311	Iron and Steel Mills and Ferroalloy Manufacturing
3312	Steel Product Manufacturing from Purchased Steel*
3313	Alumina and Aluminum Production and Processing
3314	Nonferrous Metal (except Aluminum) Production and Processing*
3315	Foundries*
3321	Forging and Stamping
3322	Cutlery and Handtool Manufacturing
3324	Boiler, Tank, and Shipping Container Manufacturing
3327	Machine Shops; Turned Product; and Screw Nut and Bolt Mfg
3328	Coating, Engraving, Heat Treating, and Allied Activities,
3329	Other Fabricated Metal Product Manufacturing
3335	Metalworking Machinery Manufacturing
3339	Other General-Purpose Machinery Manufacturing
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers

Note: * = super-performing industries

A portion of the Growing Legacy Manufacturing GRID is super-performing manufacturing industries, which show double-digit output growth, moderate productivity, and strong export power—defined by 6 to 8 times higher concentrations in the region compared to national figures.[18] For super-performing industries, the increase in productivity from 2013 to 2017 was at least 28% with a four-fold average increase in regional specialization (Figure 6). Specific industries include the *Paint, Coating, and Adhesive Manufacturing* (3255), *Steel Product Manufacturing from Purchased Steel* (3312), *Nonferrous Metal (except Aluminum) Production and Processing* (3314), and *Foundries* (3315).

Another 15 manufacturing industries consist of growing legacy manufacturing industries with significant export capacity (between 2 and 5 times the U.S.), productivity growth, and high regional importance. For a long time, these industries were critiqued as prone to laying off laborers and draining the region; however—as this data-driven approach shows—these industries adopted innovative technology processes and not only survived fierce domestic and international competition but came back with strong growth and resilient supply chains.

Four industries of Legacy Manufacturing —the *Basic Chemical Manufacturing* (3251), *Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing* (3252), *Soap, Cleaning Compound, and Toilet Preparation Manufacturing* (3256), and *Other Chemical Product and Preparation Manufacturing* (3259)—experienced 40%-60% growth in output and productivity over 2013-2017 period (Figure 7). These industries are already components of a robust local chemical and petrochemical manufacturing. In anticipation of the Shell cracker being operational in 2020,[19] these industries are strategically growing their ability to absorb future locally produced feedstock[20] and establish a secondary petrochemical manufacturing hub in the U.S.[21]

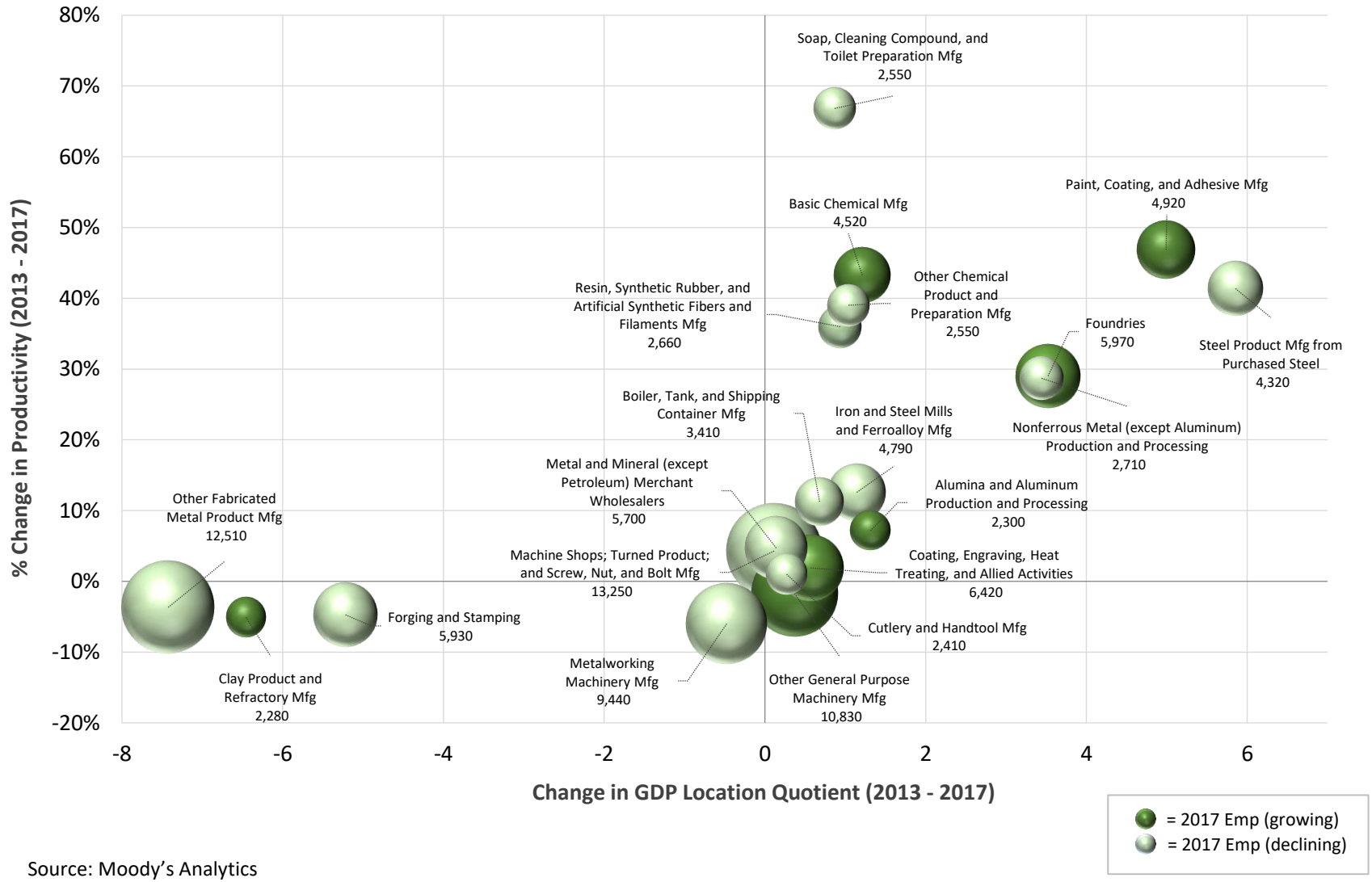
[18] Concentration is measured by location quotient, which is computed as an industry's share of a regional total for some economic statistic (output or employment by metropolitan area) divided by the industry's share of the national total for the same statistic.

[19] The Royal Dutch Shell Company is building an ethane cracker plant in Beaver County, Pennsylvania. A cracker plant "cracks" ethane molecule into petrochemical building blocks that can be refined to create polyethylene, a plastic used for various purposes, from food packaging to automotive parts. The entire 340-acre complex will consist of the cracker, three units which will convert ethylene into polyethylene pellets, a natural gas-fired power plant, a loading dock, and a wastewater plant. Manufacturing of plastics is expected to be a major outcome of the operation. The project is expected to be operational in the early 2020s. For more information see "Cracker plant takes shape in Beaver," July 1, 2018.

[20] A partnership between South Korea-based Daelim Industrial Co. and PTT Global Chemical PCL committed to build a second ethane regional cracker in Belmont County, Ohio. They announced that this cracker's size would be nearly double that of the Shell cracker. For more information see "Proposed Ohio Ethane Cracker Now to Rival Shell Project," March 12, 2018.

[21] The largest petrochemical hub in the U.S. is located in the Gulf Coast region, encompassing Texas and Louisiana.

Figure 7. Legacy Manufacturing GRID - Industry Dynamics, Productivity, and Specialization



Source: Moody's Analytics

GRIDs and Supply-Chain Industries

Industries are inter-connected through buy-sell supply-chain relationships, meaning that one industry not only contributes to the economy through its output, but through the "trickle-down effect" of the money it spends on goods and services to bring its product or service to market. We examined GRIDs supply-chain spending through IMPLAN's matrix of inter-industry transactions.[22]

GRID industries sell their goods and services to other industries. Table 5 displays GRIDs, sales GRIDs make to all industries in NEO, and sales GRIDS make to non-GRID industries. To accurately account for these supply-chain relationships, it is important to remove all sales that GRID industries make to each other. Total sales by GRIDs to other industries equals $46.8 billion, while total sales to non-GRID industries by GRIDs equals $31.8 billion. Interestingly, the Professional Services GRID accounts for nearly 90% of these sales (Table 5).

Table 5. GRIDs Sales

GRIDs	Sales to all industries in NEO	Sales to Non-GRIDs in NEO	% Sales to Non-GRIDs
Oil & Gas	$2.4B	$1.7B	70.8%
Professional Services	$41.9B	$28.3B	67.5%
Growing Legacy Manufacturing	$2.6B	$1.8B	69.2%
All GRIDs	**$46.8B**	**$31.8B**	**67.8%**

GRIDs industries also serve as customers, making purchases from other industries to produce their goods and services. As consumers, GRIDs purchase $66.1 billion from all NEO industries (Table 6). Of this amount, $50.3 billion (76.2%) is purchased from non-GRID industries. Again, the Professional Services GRID accounts for nearly 90% of these purchases.

Table 6. GRIDs Purchases

GRIDs	Purchases from all industries in NEO	Purchases from Non-GRIDs in NEO	% Purchases from Non-GRIDs
Oil & Gas	$2.6B	$1.1B	42.3%
Professional Services	$54.5B	$42.9B	78.7%
Growing Legacy Manufacturing	$9.0B	$6.2B	68.9%
All GRIDs	**$66.1B**	**$50.3B**	**76.1%**

[22] Reading across the rows of the IMPLAN matrix of inter-industry transactions illustrates sales of one industry to all other industries in the region. Note that these transactions include only sales to industries for intermediate use, and do not capture the sale of finished goods.

DECLINING ECONOMIC BASE

Even after the recession, many legacy manufacturers continue to lose competitive advantage and regional specialization because they are behind the curve at adapting to the new technology-driven manufacturing market. Twenty-five (25) manufacturing industries are part of the regional economic base, heavily concentrated in our region, and currently lagging in economic performance (Figure 8). We describe these industries as "declining economic base industries".

The declining economic base industries accounted for $12.7 billion of output in NEO and represented a significant portion of employment, retaining over 110,000 jobs in 2017. Many industries in this group saw double-digit employment losses over the last five years and had a negative local competitive advantage, even though they maintained or grew their output levels. It is a lack of competitiveness in wealth production which excludes them from the GRIDs.

We examine those non-restructured manufacturing industries in comparison to national growth as the nation is growing at a higher rate than NEO. Figure 8 displays the NEO output growth rate to the national output growth rate over the same period, 2013 to 2017. Overall, promising industries such as the *Plastics Product Manufacturing* (NAICS 3261) industry showed signs that this industry should be regionally fostered because it has large and growing output, and this industry is growing at the national level.

Nearly 65% of the non-restructured manufacturing industries increased their real output from 2013 to 2017. On average, these 16 industries grew output by 11.8%. Manufacturing of *other wood products, household and institutional furniture and kitchen cabinets, converted paper products, glass and glass products* have seen double-digit growth in output. Two manufacturing industries (*pulp, paper, and paperboard mills*; and *agriculture, construction, and mining machinery*) grew in Northeast Ohio despite declining output in the U.S. However, large employers (*plastics product manufacturing* and *motor vehicle parts*) increased their output at a lower than national rates.

Figure 8. Non-Restructured Manufacturing

NAICS Code	Manufacturing Industry Name	2017 NEO GDP	% Change in GDP (2013-2017) NEO	% Change in GDP (2013-2017) U.S.
3219	Other Wood Product	$243 M	35.2%	20.9%
3371	Household and Institutional Furniture and Kitchen Cabinet	$219 M	31.3%	26.7%
3222	Converted Paper Product	$795 M	23.6%	7.4%
3272	Glass and Glass Product	$110 M	18.1%	22.7%
3399	Other Miscellaneous	$516 M	12.9%	5.8%
3362	Motor Vehicle Body and Trailer	$241 M	9.9%	44.8%
3261	Plastics Product	$1,961 M	8.1%	22.4%
3221	Pulp, Paper, and Paperboard Mills	$142 M	8.1%	-0.5%
3363	Motor Vehicle Parts	$2,154 M	7.8%	14.0%
3231	Printing and Related Support Activities	$709 M	6.3%	2.7%
3334	Equipment	$254 M	5.9%	8.7%
3332	Industrial Machinery	$423 M	5.9%	13.0%
3331	Agriculture, Construction, and Mining Machinery	$306 M	5.4%	-18.5%
3323	Architectural and Structural Metals	$682 M	5.0%	15.9%
3325	Hardware	$70 M	2.9%	11.0%
3279	Other Nonmetallic Mineral Product	$193 M	1.6%	25.3%
3391	Medical Equipment and Supplies	$578 M	-0.4%	9.8%
3333	Commercial and Service Industry Machinery	$176 M	-0.5%	5.5%
3262	Rubber Product	$533 M	-1.8%	15.1%
3326	Spring and Wire Product	$86 M	-2.8%	6.2%
3359	Other Electrical Equipment and Component	$435 M	-6.2%	9.2%
3352	Household Appliance	$299 M	-7.2%	13.2%
3353	Electrical Equipment	$747 M	-8.0%	-2.3%
3361	Motor Vehicle	$747 M	-22.3%	18.5%
3351	Electric Lighting Equipment	$33 M	-26.8%	22.6%

Nine industries within the declining economic base recorded a decline in their output regionally, at an average rate of -8.4%. *Electric Lighting Equipment Manufacturing* (3333) saw the largest decline in the region over the past five years, with GDP decreasing by 27%. At the national level, the industry's GDP grew by 23%. *Motor Vehicle Manufacturing* (3361) also declined in GDP by 22% in the region, compared to 19% growth nationally. Two industries with double-digit growth nationally, rubber product and household appliance manufacturing, declined regionally. *Electrical Equipment Manufacturing* (3353) is the only industry among the declining economic base industries that saw a decline in output both regionally (8%) and nationally (2%).

CONCLUSIONS AND TAKEAWAYS

This analysis identified industries with strong regional specialization as export industries, which grew output, increased productivity and illustrated positive components of local competitiveness over the last five years. [23] In all, three groups of industries met these criteria: *Professional Services*, *Growing Legacy Manufacturing*, and *Oil and Gas*. These three industry groups were identified as Groups of Regional Industry Drivers, or GRIDs, and combined they produce one-third of NEO's economic wealth. GRIDs drive the regional economy by selling $31.8 billion of their products to non-GRID industries for intermediate use and purchase $66.1 billion from non-GRID industries to produce as output.

- The Professional Services GRID provided the largest share of output, 71% ($61 billion), among all GRIDs. The core of this group are industries such as finance and insurance, company headquarters, hospitals, and real estate. The growth of these industries is driven by increasing productivity, and they are important to the overall vitality of the region because they have significant regional specialization.
- The Growing Legacy Manufacturing GRID consisted of 20 industries in steel-making, machine shops, chemical and tools manufacturing, with a high concentration in the region compared to the U.S. They were responsible for 22% ($19 billion) of GRIDs output and showed strong growth. These industries emerged from the recession restructured and competitive.
- The Oil and Gas GRID is an emerging industry group for the NEO economy; it is small, but being capital-intensive, it contributes sizeably to output. In 2017, industries in this group accounted for 7% of GRIDs output, or $6 billion. The *Oil and Gas Extraction* (NAICS 2111) industry showed double-digit growth in output and rapidly growing specialization since the recession. The Oil and Gas GRID needs to increase in size and economy of scale to significantly impact overall regional performance.
- About half of NEO legacy manufacturing industries are struggling. They are losing competitive advantage and regional specialization while attempting to adopt new technologies.

[23] Based on analysis of regional and national employment and output.

NEO economy is becoming more aligned with the overall U.S. structure, which can protect it from recessionary pressures in the manufacturing sector. While expanding the regional economy to the service sector is desired, a closer look reveals a significant gap in service sector productivity between NEO and the U.S. The gap may indicate a risk of falling behind, as this sector creates the infrastructure to develop and deploy innovation.

According to commercial real estate services firm CBRE, Cleveland is ranked #8 among the top 10 fastest-growing Tech Talent Markets in North America in 2018.[24] Having the Cleveland Clinic and Case Western Reserve University near other university assets (e.g., Carnegie Mellon, The Ohio State University, University of Wisconsin, and University of Michigan), creates a synergy in starting medical technology, cybersecurity, advanced manufacturing, and data science regions.[25] These potential drivers are not yet visible in data about regional performance; they are currently anecdotal evidence worthy of attention from Silicon Valley investors. How the region can translate this potential into the competitive sector of local research, innovation, development, and company deployment is a new task for economic development intermediaries.

Overall, the NEO's regional economy shows signs of growth; however, there are significant strides that need to take place for it to catch up to other Midwest regions and the nation regarding output and employment.

[24] CBRE. (2018, July 21). Momentum: The fastest growing tech talent markets. Retrieved from https://www.cbre.com/research-and-reports/Scoring-Tech-Talent-in-North-America-2018

[25] Twelve Rust Belt states generate 26% of the nation's corporate and university patents and 31% of university-based research and development, produce 35% of the nation's total bachelor's degree holders, house more than 200 of the Nation's Fortune 500 companies and 20 of the world's top 200 research universities. Source; Austin, J.C. (2018, August 14). The Rust Belt needs capital to turn talent and innovation into jobs. *Brookings*.